Alcohol Drinking Patterns and Health Care Utilization in a Managed Care Organization

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Objective. To estimate the relationship between current drinking patterns and health care utilization over the previous two years in a managed care organization (MCO) among individuals who were screened for their alcohol use.

Study Design. Three primary care clinics at a large western MCO administered a short health and lifestyle questionnaire to all adult patients on their first visit to the clinic from March 1998 through December 1998. Patients who exceeded the National Institute on Alcohol Abuse and Alcoholism (NIAAA) guidelines for moderate drinking were given a more comprehensive alcohol screening using a modified version of the Alcohol Use Disorders Identification Test (AUDIT). Health care encounter data for two years preceding the screening visit were linked to the remaining individuals who responded to one or both instruments. Using both quantity–frequency and AUDIT-based drinking pattern variables, we estimated negative binomial models of the relationship between drinking patterns and days of health care use, controlling for demographic characteristics and other variables.

Principal Findings. For both the quantity–frequency and AUDIT-based drinking pattern variables, current alcohol use is generally associated with less health care utilization relative to abstainers. This relationship holds even for heavier drinkers, although the differences are not always statistically significant. With some exceptions, the overall trend is that more extensive drinking patterns are associated with lower health care use.

Conclusions. Based on our sample, we find little evidence that alcohol use is associated with increased health care utilization. On the contrary, we find that alcohol use is generally associated with decreased health care utilization regardless of drinking pattern.

Key Words. Alcohol, health care utilization, alcohol screening

Alcoholism and alcohol abuse impose significant costs on society. One consequence that has received much attention is the possibility that alcohol abuse leads to increased health care utilization. Although the alcohol treatment cost offset literature (e.g., Holder and Blose 1991, 1992; Holder and Cunningham 1992; Holder, Lennox, and Blose 1992) has demonstrated that untreated alcoholics have greater health care utilization than nonalcoholics, it does not shed light on the relationship between the level and intensity of alcohol use (as opposed to abuse or dependence) and health care utilization.

Because the number of alcohol users is much greater than the number of dependent or abusive drinkers,[1] understanding the relationship between alcohol use patterns and health care utilization is important to policymakers. Once this relationship is understood, policymakers need to understand the underlying reasons for the relationship and whether a screening intervention is warranted to detect and change these patterns. Our article contributes to the first part of this research by examining the relationship between alcohol drinking patterns and health care utilization.

Several recent studies have examined the relationship between alcohol consumption and health care utilization. In general, the results appear counterintuitive in light of the cost offset literature. For example, Armstrong, Midanik, and Klatsky (1998) found in a survey of health maintenance organization (HMO) users that the heaviest drinkers (as measured by weekly consumption), after adjusting for age and race, had fewer hospital days, fewer hospitalizations, and fewer outpatient visits than abstainers. Rice et al. (2000) examined the relationship between health care use (outpatient visits and odds of hospital use) and alcohol use collected from a member survey at an HMO. Results indicate that current drinkers had lower rates of health care utilization than nondrinkers and that nondrinkers with a drinking history had substantially greater utilization than nondrinkers without a history. Polen et al. (2001) examined the relationship between alcohol consumption (based on a user survey at an HMO) and health care utilization (health care costs, outpatient visits, inpatient days, and emergency room visits). Several patterns of alcohol consumption were created from the AUDIT, including drinks per month. No strong, consistent relationship was found between the multiple drinking patterns and health care utilization cost and use. However, they found that nondrinkers had greater health care costs and utilization than drinkers. Cryer et al. (1999) examined the relationship between alcohol consumption and acute and preventive health care use for a random sample of adults in South East England. They found that although heavy drinkers used more acute care, they also used less preventative care. Interestingly, they

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found that abstainers were also overusers of acute care but underusers of preventative services.

These findings of a negative relationship between alcohol use and health care utilization (with the exception of Cryer et al. 1999) are consistent with the possibility that moderate alcohol consumption may provide beneficial health effects, which in turn may lead to lower health care utilization. Numerous studies have found that moderate alcohol use is associated with reduced risk of coronary heart disease and with reduced overall mortality within certain populations (Doll 1998; Chick 1998; Klatsky 1999; Ashley et al. 1994). Indeed, Doll (1998) concluded that alcohol consumption in the range of one to four drinks *per day* is associated with reductions in the risk of premature death. Unfortunately, much of the previous literature on alcohol use and health care utilization has focused on measures of *weekly* or *monthly* alcohol consumption, and so we cannot determine if the beneficial health effect of regular, moderate drinking explains the results of this literature (an exception is Rice et al. 2000, which used drinks per day). Nor has previous health services research taken into account the quantity–frequency pattern of drinking as we do here. There is evidence, for example, that frequent binge drinking—which is a typical pattern in Russia, Poland, and the Baltic states—is associated with increased mortality and morbidity (Chenet et al. 1998). Further complicating the putative association between drinkers and abstainers is the issue that abstainers include never drinkers and former drinkers, and these two groups are very different. For example, Fillmore et al. (1998) found that former drinkers are more likely to have health risk factors such as cigarette smoking, depression, and obesity. Polen et al. (2001) found that former drinkers have higher health care costs than never drinkers and light drinkers.

This study expands the previous literature on the relationship between alcohol use and health care utilization in an MCO by examining two different drinking pattern measures: quantity-frequency and alcohol problem severity measures. In addition, we have included covariates for two important health behaviors—smoking and exercising. Controls for exercise have not been available in the previous literature. We have also included more traditional demographic factors, such as age and gender.

Data and Methods

Data

Data for this analysis were collected as part of Cutting Back®, a six-year, five-site national research project evaluating the application of alcohol screening

and brief intervention (SBI) activities in primary care settings of MCOs. The project objectives were to evaluate the implementation, drinking outcomes, and cost-benefit of two different models of SBI that were implemented in two experimental clinics from each MCO. A third clinic from each MCO served as a comparison clinic.

Three primary care clinics from a large western staff-model MCO provided the data for the analyses used in this report. A short health and lifestyle questionnaire was administered to consenting adult patients (ages 18 and older) on their first visit to the clinic during program operations ($N = 18{,}568$). Patients in the two experimental clinics ($N = 12{,}161$) who scored positive on this questionnaire were given a more comprehensive alcohol screening using the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al. 1993), adjusted for the American standard drink. The AUDIT is a 10-item screener that has been shown to be effective in identifying hazardous drinking as well as alcohol abuse and dependence in a wide range of populations (Allen et al. 1997). AUDIT scores were used to classify individuals into drinking groups based on drinking patterns and severity of alcohol problems.[2] Patients in the control clinic ($n = 6{,}407$) received the preliminary health and lifestyle questionnaire only. For the analyses reported in this paper, health care utilization data for two years prior to the screening visit were obtained from MCO health encounter data files. The month in which the actual screening visit occurred was not included in this two-year period. Of the 18,568 individuals screened, we were able to match 17,305 individuals to the encounter data.

In addition to the health care utilization measures, we obtained information on the patient's gender and age as of the screening date. These data were then merged with the health and lifestyles questionnaire and AUDIT data. We limited our dataset to individuals under the age of 65 ($n = 14{,}421$) because these individuals are likely to have substantially different health care utilization than older individuals. Finally, some individuals were lost due to item nonresponses on key explanatory variables, such as drinking, smoking, and exercise ($n = 126$). Our final analysis sample included 14,295 individuals with 8,994 in the treatment clinics and 5,301 in the control clinic.

Summary health care utilization measures were created to reflect the total number of days of care over the two-year period prior to the screening visit. We categorized care into three mutually exclusive types based on the location of the encounter: outpatient (OP) care, inpatient (IP) care, and emergency room (ER) care. All days that occurred between the begin date and end date of an encounter with a "room and board" type of service were

defined as IP days. Any days not classified as IP were classified as either ER or OP. Emergency room visits were defined using the admission priority, place of service, type of service, and service department. Outpatient care was then defined as a residual category and therefore includes any contact with the MCO not previously classified (e.g., primary care visits, lab visits). Details on the exact codes used to classify IP, OP, and ER are available upon request.

Patients' encounter data were merged with their responses to the health and lifestyle questionnaire instrument and the AUDIT (for the subsample who received it). The health and lifestyle questionnaire asked about both the frequency with which the respondent consumed alcohol ("How often do you have a drink containing alcohol?") and the quantity of drinks he or she typically consumed on drinking occasions ("How many drinks containing alcohol do you have on a typical day you are drinking?"). These questions on the health and lifestyle questionnaire, which are also the first two items on the AUDIT (self-report version), did not refer to a specific time period. The frequency categories were: never, less than monthly, monthly, weekly, 2 to 3 times a week, 4 to 6 times a week, or daily. The quantity categories were: 1, 2, 3, 4, 5–6, 7–9, or 10 or more drinks. Based on their quantity and frequency of alcohol consumption, we categorized individuals into the following 10 drinking pattern categories: abstainers, infrequent light drinkers, infrequent medium drinkers, infrequent heavy drinkers, frequent light drinkers, frequent medium drinkers, frequent heavy drinkers, daily light drinkers, daily medium drinkers, and daily heavy drinkers. Abstainers were defined as individuals who reported that they never have a drink with alcohol. Infrequent drinkers consume alcohol less than weekly, frequent drinkers consume alcohol weekly but less than daily, and daily drinkers consume alcohol daily. The quantity categories were defined differently for men and women. For men, light drinkers have 1 or 2 drinks on a typical drinking occasion, medium drinkers have 3 drinks per occasion, and heavy drinkers have 4 or more drinks per occasion. For women, light drinkers have 1 drink on a typical drinking occasion, medium drinkers have 2 drinks per occasion, and heavy drinkers have 3 or more drinks per occasion.

The health and lifestyle questionnaire was used to identify risky drinkers, defined as individuals who consume alcohol in excess of the NIAAA guidelines for moderate drinking (U.S. Department of Agriculture and U.S. Department of Health and Human Services 2000): 7 or more standard drinks per week for females and those aged 65 or older, 14 or more drinks for younger males, or 4 or more drinks on an individual occasion. Abstainers and low-risk drinkers were given no further assessments. Risky drinkers in the

intervention clinics were given the AUDIT. Responses to the AUDIT were then used to classify risky drinkers (see Babor et al. 2001) into Zone I (AUDIT scores less than 16) or Zone II (AUDIT scores greater than or equal to16). Because the AUDIT was administered only to patients in the two experimental clinics, the sample size ($N = 8{,}994$) is smaller in analyses that examine the AUDIT-based drinking patterns than in analyses that use the quantity–frequency based drinking patterns.

The AUDIT-based patterns, or drinking zones, classify individuals by symptomatic behavior in addition to quantity and frequency of drinking. Low-risk drinkers' weekly alcohol consumption falls within NIAAA guidelines (U.S. Department of Agriculture and U.S. Department of Health and Human Services 2000). Zone I drinkers consume alcohol above the specified guidelines and are thus considered "at risk." Zone II drinkers drink in excess of the guidelines and exhibit potential symptomatic behaviors that may be indicative of alcohol abuse or dependence.

In addition to the alcohol questions, the health and lifestyle questionnaire also asked respondents about their smoking and exercise habits. Using this information, we created indicators for the following health habits: not smoking, moderate exercise (defined as exercising one or two days per week), and heavy exercise (defined as exercising three or more days per week). Because smoking and exercise may be correlated with alcohol use, we included both variables in our analyses to isolate the effect of alcohol use. Finally, because abstainers could include both lifetime abstainers and former drinkers, we created an indicator variable that equaled 1 if the individual had any alcohol, drug abuse, or mental health (ADM)-related utilization in the two years spanned by our encounter data.[3] Although not a perfect proxy for past alcohol problems, this indicator partially captures differences between former drinkers and lifetime abstainers. This indicator will be positively related to total health care utilization because ADM care is a component of total care, but the magnitude of the relationship will be influenced by the effect of past alcohol problems, which may vary greatly. Furthermore, by including this indicator, we isolate the effect of current alcohol use from past ADM problems. However, another perspective is that current smoking may be induced by current drinking. If so, then to estimate the total effect of current alcohol use on health care utilization, we should exclude smoking. Similarly, to the extent that current alcohol use is correlated with the ADM indicator, the ADM indicator may partially mask the full effect of alcohol. We discuss below the effect of dropping both smoking and the ADM indicator on the alcohol coefficients.

Finally, because not all individuals were fully enrolled during the entire two-year period, we included a covariate for log of months enrolled. We also added clinic dummy variables to control for differences between the two experimental clinics.

Methods

Because we have counts of the number of days of health care utilization (e.g., 0, 1, 2, 3), traditional regression models are inappropriate for our analyses. Therefore, a negative binomial model was used to evaluate the relationship between drinking patterns and health care use (Jones 2000).

The specification for the negative binomial model is

$$Y = f(\beta_0 + \beta_1 AGE + \beta_2 MALE + \beta_3 HLTH + \beta_4 ADM + \beta_5 ENROLL + \beta_6 CLINICS + \beta_7 DRINKCAT), \quad (1)$$

where Y represents the number of days of health care use and f represents the negative binomial distribution. *AGE* is the patient's age on the screening date, and *MALE* is an indicator variable for gender. *HLTH* is the set of indicator variables reflecting smoking status and frequency of exercise. *ADM* is an indicator for whether or not an individual had an alcohol, drug, or mental health service in the two years prior to screening. *ENROLL* is the log of months enrolled in the health plan. *CLINICS* represents dummy variables for each of the two experimental clinics. *DRINKCAT* is a set of indicator variables reflecting the drinking categories described above. Abstainers are omitted from this categorization and serve as the reference group. We estimated equation (1) for each type of health care defined above: IP, OP, and ER.

The βs are coefficients to be estimated. Because of the nonlinearity of the negative binomial distribution, the βs are not directly interpretable. However, the βs can be easily transformed into incident rate ratios (IRRs). The IRRs describe the change in the days of health care use associated with a one-unit increment in an explanatory variable as a multiple of the utilization of the reference group. For example, if the IRR associated with β_2 is 1.5, males use 1.5 times as many days of care as females.

RESULTS

Table 1 presents the means of the analysis variables. Approximately 9 percent of the sample sought IP care in the two years covered by the data, roughly 94 percent sought OP care, and about 22 percent sought ER care. Conditional on

Table 1: Means of Dependent and Independent Variables

Variable	*Mean (N= 14,295)*
Days of Health Care Use	
Proportion of sample with at least one inpatient visit	0.089
	(0.284)
Inpatient days (total number)	0.397
	(3.164)
Inpatient days (conditional on positive utilization)	4.472
	(9.732)
Proportion of sample with at least one outpatient visit	0.940
	(0.237)
Outpatient days (total number)	13.231
	(14.132)
Outpatient days (conditional on positive utilization)	14.072
	(14.162)
Proportion of sample with at least one emergency room visit	0.221
	(0.415)
Emergency room days (total number)	0.385
	(1.084)
Emergency room days (conditional on positive utilization)	1.740
	(1.717)
Demographic Characteristics	
Age	40.81
	(12.316)
Male	0.377
	(0.485)
Smokers	0.233
	(0.423)
Moderate exercise	0.320
	(0.467)
Heavy exercise	0.461
	(0.498)
Alcohol, Drug Abuse, or Mental Health (ADM) Care	
Proportion of sample with at least one day of ADM care in the past two years	0.252
	(0.434)

Note: Standard deviation shown in parentheses.

seeking care, the mean number of IP days of care is approximately 4.5 days, the mean number of ER days of care is just under 2, and the mean number of OP days of care is approximately 14. Although the mean days of OP care may seem high, recall that OP is a residual category that includes all contact with MCOs not previously classified as either IP or ER. The sample consists of 38 percent males; the average age of our sample is approximately 41 years, and the majority of our sample (77 percent) does not smoke. Just more than 20

percent of the sample did not exercise on a regular basis, and almost half of the sample exercised three or more days a week.

Table 2 presents the distribution of drinking patterns and the mean number of estimated drinks per week. Approximately 28 percent of our sample are abstainers,[4] and the modal drinking category is infrequent light (30 percent); very few people drank daily. Approximately 61 percent of the sample were low-risk drinkers, and 10 percent were Zone I drinkers. Drinks per week were estimated by converting the categorical drinking responses into a continuous weekly measure. The most prevalent category, infrequent light drinkers, consumed only 0.12 drinks per week. In contrast, frequent heavy

Table 2: Distribution of Drinking Patterns

Variable	*N*	*Mean Drinks per Week*	*Sample Proportion*
Quantity–Frequency(QF)-Based Drinking Patterns			
Abstainers	3,945	0	0.276
			(0.447)
Infrequent light drinkers	4,159	0.122	0.291
		(0.130)	(0.454)
Infrequent medium drinkers	1,520	0.299	0.106
		(0.232)	(0.308)
Infrequent heavy drinkers	780	0.654	0.055
		(0.520)	(0.227)
Frequent light drinkers	1,596	2.970	0.112
		(2.351)	(0.315)
Frequent medium drinkers	1,047	4.782	0.073
		(3.350)	(0.261)
Frequent heavy drinkers	901	9.354	0.063
		(7.771)	(0.243)
Daily light drinkers	141	10.475	0.010
		(3.512)	(0.099)
Daily medium drinkers	104	17.5	0.007
		(3.517)	(0.085)
Daily heavy drinkers	102	37.059	0.007
		(16.820)	(0.084)
AUDIT-Based Drinking Patterns			
Abstainers	2,497	0	0.278
			(0.448)
Low-risk drinkers	5,517	1.136	0.613
		(1.921)	(0.487)
Zone I drinkers	909	10.302	0.101
		(8.401)	(0.301)
Zone II drinkers	71	26.989	0.008
		(22.192)	(0.089)

Note: Standard deviation shown in parentheses.

drinkers consumed 9.4 drinks per week, which is approximately 1 drink per week less than the daily light drinkers and the Zone I drinkers.

The first two columns of Table 3 presents the results of estimating equation (1) for IP days using a negative binomial model and the quantity-frequency based categories. Given the functional form, it is easier to interpret the coefficients in terms of IRRs, defined as e^{β}, where β represents the coefficient estimate of the variable of interest. The IRR expresses the effect of the variable as a multiple of the reference category. For the drinking variables, the reference category is abstainers. For example, the IRR for "infrequent light

Table 3: Negative Binomial Regression Results—Quantity/Frequency (QF) Categories—Reported as Coefficient Estimates and Incidence Rate Ratios (IRRs)

	Inpatient Days		*Outpatient Visits*		*Emergency Room Visits*	
	Coefficient	*IRR*	*Coefficient*	*IRR*	*Coefficient*	*IRR*
Intercept	−3.756***	—	−0.533***	—	−2.065***	—
	(0.288)		(0.047)		(0.143)	
QF-Based Drinking Patterns						
Infrequent light drinkers	−0.299***	0.741***	−0.113***	0.893***	−0.332***	0.717***
	(0.113)	(0.084)	(0.018)	(0.016)	(0.051)	(0.036)
Infrequent medium drinkers	−0.488***	0.614***	−0.191***	0.826***	−0.494***	0.610***
	(0.158)	(0.097)	(0.025)	(0.020)	(0.072)	(0.044)
Infrequent heavy drinkers	−0.433**	0.649**	−0.160***	0.852***	−0.354***	0.702***
	(0.217)	(0.141)	(0.033)	(0.028)	(0.091)	(0.064)
Frequent light drinkers	−0.507***	0.602***	−0.229***	0.795***	−0.655***	0.519***
	(0.159)	(0.096)	(0.025)	(0.019)	(0.077)	(0.040)
Frequent medium drinkers	−1.076***	0.341***	−0.343***	0.710***	−0.709***	0.492***
	(0.184)	(0.063)	(0.028)	(0.020)	(0.087)	(0.043)
Frequent heavy drinkers	−1.185***	0.306***	−0.348***	0.706***	−0.589***	0.555***
	(0.207)	(0.063)	(0.031)	(0.022)	(0.092)	(0.051)
Daily light drinkers	−0.781*	0.458*	−0.156**	0.855**	−0.257	0.773
	(0.444)	(0.203)	(0.069)	(0.059)	(0.211)	(0.163)
Daily medium drinkers	−1.130**	0.323**	−0.268***	0.765***	−0.581**	0.560**
	(0.529)	(0.171)	(0.081)	(0.062)	(0.253)	(0.142)
Daily heavy drinkers	−1.063**	0.345**	−0.332***	0.718***	−0.430*	0.651*
	(0.522)	(0.180)	(0.082)	(0.059)	(0.237)	(0.154)

Notes: (1) Standard error in parentheses,
(2)*Significant at the .10 level,
(3)**Significant at the .05 level,
(4)***Significant at the .01 level.
IRR is the incidence rate ratio defined as e^{β}, where β is the coefficient estimate.

drinkers" in the inpatient days model is 0.741. Because this is less than one, infrequent light drinkers use fewer days of inpatient care than abstainers. More precisely, they use approximately 25.9 percent fewer (1–0.741) days of inpatient care than abstainers. Note that all the IRR estimates for the alcohol use variables are less than 1 for inpatient days (and significant at the 0.10 level), which means that all drinking patterns are associated with less health care use than abstainers. In addition, frequent medium drinkers ($p<.01$), frequent heavy drinkers ($p<.01$), daily medium drinkers ($p<.05$), and daily heavy drinkers ($p<.05$) have even fewer days of care than infrequent light drinkers, with frequent heavy drinkers having the fewest.

A similar but more pronounced pattern holds for OP and ER visits. For both types of health care utilization, drinkers are associated with less health care than abstainers. Furthermore, although there are some exceptions, the overall trend is that more extensive drinking patterns are associated with lower use of OP and ER care. For example, frequent heavy and daily heavy drinkers ($p<.01$) have relatively fewer days of OP care, and frequent medium and frequent heavy drinkers ($p<.05$) have relatively fewer days of ER care.

Turning to the other variables (not reported here but available on request), men use less IP ($p<.05$), OP ($p<.01$), and ER ($p<.01$) care. Smokers use less OP care ($p<.01$) but more ER care ($p<.01$). Moderate ($p<.10$) exercisers use less ER care than light/nonexercisers. Individuals who had ADM care in the past two years had between 1.8 and 2.2 times as many days of health care use as those who did not have any ADM care.

Finally, we performed a series of chi-squared tests (available upon request). The first set of tests evaluated whether the frequency coefficient estimates are the same within quantity categories (light, medium, and heavy). For example, one test examined the equality of the infrequent light, frequent light, and daily light coefficients. Because the quantity of use is the same in each of these categories (e.g., light use), rejecting the hypothesis of equality means that the frequency pattern of alcohol use has a differential effect on health care utilization, holding quantity constant. The results are somewhat mixed, but we find that the most consistent results are associated with OP days, where we reject equality at the 1 percent level or better for all three drinking categories. Thus, there is strong evidence that, holding quantity constant, OP care differs by the frequency of alcohol consumption. The next set of tests evaluated whether the coefficient estimates are the same within frequency categories (infrequent, frequent, and daily). Thus, these statistics tested whether, holding frequency constant, differences in health care utilization exist based on the quantity of alcohol consumed. Generally, the results show

no significant differences within the daily drinking categories, suggesting that health care utilization does not vary by the quantity of alcohol consumed. However, in the frequent category, heavy drinkers use significantly less IP and OP care than light drinkers ($p < .05$).

Table 4 presents the negative binomial results using the AUDIT categories. Overall, these results reinforce the findings from the quantity–frequency categories: (1) the point estimates of all drinking categories are negative and significant, except for ER visits for Zone II drinkers, suggesting that drinkers use less health care than abstainers, and (2) as drinking levels increase from low-risk drinking to Zone I, all three types of health care utilization significantly decrease. However, unlike the quantity–frequency results in Table 3, as utilization increases to Zone II, where drinkers exhibit higher risk levels indicative of harmful alcohol use and alcohol dependence, the point estimates are less negative and less significant compared to the Zone I coefficient. The coefficients on the remaining demographic and ADM care variables are very similar to the Table 3 results.

To explore further the potential impact of gender differences on our results, we also estimated equation (1) separately for males and females. The sign and magnitude pattern of the results were similar for both males and

Table 4: Negative Binomial Regression Results—AUDIT Categories—Reported as Coefficient Estimates and Incidence Rate Ratios (IRRs

	Inpatient Days		*Outpatient Visits*		*Emergency Room Visits*	
	Coefficient	*IRR*	*Coefficient*	*IRR*	*Coefficient*	*IRR*
Intercept	−3.383***	—	−0.491***	—	−1.879***	—
	(0.353)		(0.057)		(0.171)	
AUDIT-Based Drinking Patterns						
Low-risk drinkers	−0.296**	0.744**	−0.158***	0.854***	−0.381***	0.683***
	(0.130)	(0.097)	(0.019)	(0.017)	(0.054)	(0.037)
Zone I drinkers	−1.455***	0.233***	−0.352***	0.703***	−0.765***	0.466***
	(0.224)	(0.052)	(0.033)	(0.023)	(0.099)	(0.046)
Zone II drinkers	−1.167*	0.311*	−0.192**	0.825**	0.004	1.004
	(0.656)	(0.204)	(0.096)	(0.080)	(0.238)	(0.239)

Notes: (1) Standard error in parentheses,
(2)*Significant at the .10 level,
(3)**Significant at the .05 level,
(4)***Significant at the .01 level.
IRR is the incidence rate ratio defined as e^{β}, where β is the coefficient estimate.

females (i.e., drinkers use less health care than abstainers). However, the effect of daily light and daily medium drinking on health care was not significant in females for both IP and OP days. The daily heavy category for females was insignificant in the case of ER days. We also estimated the equations without controls for smoking and ADM and again found that drinkers use less health care. However, the daily heavy category ceases to be significant for both IP and ER visits. Similarly, IP and OP visits for Zone II drinkers were no longer significant. A complete set of results is available upon request.

CONCLUSION

In this study, we shed light on the relationship between alcohol consumption and health care utilization using a unique dataset that merges MCO encounter data with data on drinking patterns, alcohol problem severity, and lifestyle factors. Using drinking pattern variables that capture both quantity and frequency, we examined the relationship between current drinking patterns and health care utilization over the previous two years. In addition, we used data from a standardized screening test, the AUDIT, to shed further light on this relationship.

In general, the results corroborate earlier studies showing that alcohol use is associated with lower levels of health care utilization. In the present study, which used a richer and more diverse set of alcohol use measures, all point estimates on the quantity–frequency-based alcohol variables were negative (IRRs less than 1), which suggests that drinkers, irrespective of the amount they drank, used less health care than abstainers. Or stated another way, with the exception of ER visits for Zone II drinkers, there is no evidence that even heavy drinkers used more care than abstainers, as measured by the quantity–frequency measures. A similar sign and pattern was found for the AUDIT-based measures. However, we did find evidence that the point estimates for Zone II drinkers, who exhibit risk levels indicative of harmful alcohol use and alcohol dependence, are smaller than for Zone I drinkers.

As to the importance of drinking patterns as measured by the quantity–frequency measures, the overall trend is that more extensive drinking patterns are associated with lower use of OP and ER care. Holding quantity constant and evaluating the effect of drinking frequency, we find mixed results overall. But we find evidence that the frequency pattern of alcohol matters for OP care and that daily light drinkers use significantly less OP care than infrequent light drinkers.

Importantly, our results arise from statistical models that control for a set of potentially confounding factors. Our empirical models controlled for age and two health-related behaviors (smoking and exercise) that are not generally available in encounter data but that may be correlated with both alcohol use and health care utilization. In addition, we included an indicator variable for whether individuals had sought ADM care to control partially for differences between former drinkers and lifetime abstainers. Furthermore, having received ADM-related health care in the past two years was associated with substantially higher utilization of non-ADM medical care services. These results suggest that the presence of an ADM disorder may be associated with higher health care utilization but that alcohol consumption per se is not.

Our study has some limitations. Although this study provides strong evidence on the relationship between drinking and health care utilization, caution should be exercised when generalizing our results to a broader population. Because we examine data from individuals presenting for care at a single MCO, our results may not be directly generalizable to the population of MCOs or the U.S. population. (However, the prevalence of alcohol use measured in this study [72.4 percent] is similar to past year prevalence of alcohol use [71.4 percent] in the National Household Survey on Drug Abuse [NHSDA] in 2001). Furthermore, in earlier work, we found that individuals at the MCO who were screened in the study clinics were much more likely to use health care than other individuals who did not seek care in our study clinics during the time of the study (Zarkin, Bray, and Radeva 1999). This finding suggests that even within our study MCO, care should be used when generalizing our results.

Our results demonstrate that there is generally a negative relationship between alcohol use and health care utilization, even after controlling for several potentially confounding covariates. Importantly, our results do not support a conclusion that reducing alcohol use will *cause* increases in health care utilization as might be concluded from the negative relationship estimated in this and previous papers in the literature. With our data, we are unable to control for other unobserved factors that may explain both increased alcohol consumption and reduced health care utilization, such as individuals "self-medicating" with alcohol, reducing the perceived need to visit the doctor. We are also unable to control for chronic conditions (e.g., diabetes and heart disease) that may restrict drinking, as well as lead to greater health care use. However, Rice et al. (2000) controlled for other common medical conditions, and they continue to find a significant negative relationship between alcohol consumption and outpatient visits and a negative but

insignificant relationship for hospital use. We were also unable to differentiate never drinkers from former drinkers. Polen et al. (2001) found that former drinkers have higher health costs than never drinkers and light drinkers. Thus, because our abstainer group includes both groups, the negative relationship between alcohol consumption and health care utilization may be driven by higher utilization of former drinkers. Finally, our measures of alcohol consumption did not refer to a specific time period and were gathered at the end of the two-year period covered by the health care utilization data. To the extent that the alcohol consumption measures do not reflect alcohol consumption over the two-year period, our results may misrepresent the underlying relationship.

Although our results examine more carefully the effect of alternative drinking patterns on health care utilization, more work is needed to understand the consistent, negative relationship between alcohol use and health care utilization. Possibly, as suggested by Doll (1998) and others, alcohol use may reduce mortality risk, which may lead to reduced health care utilization. On the other hand, the relationship we and others have found more likely reflects the presence of other, uncontrolled factors that affect both alcohol use and health care utilization. For example, drinkers may be less likely to seek preventive care and therefore may use less health care. This may be especially true of Zone I risky drinkers, who are ideal candidates for early intervention but are less likely than abstainers to use primary health care.

Future work should address the reasons for the negative relationship and assess the extent that alcohol users may not be receiving valuable prevention services. If these services are not being received, MCOs should screen for risky alcohol use and intervene to reduce alcohol use and increase utilization of prevention services.

NOTES

1. According to the National Household Survey on Drug Abuse (NHSDA), in 2001 the prevalence of past year alcohol use for persons aged 18 or older was 71.4 percent versus a prevalence of past month heavy alcohol use of 6.1 percent.
2. The time period for the AUDIT (self-report version) is not specified for the quantity–frequency questions, but it is specified to be the past year for the remaining questions (Babor et al. 2001). A variety of studies have demonstrated that the self-report version of the AUDIT exhibits a high level of validity, specificity, and reliability (Allen, Reinert, and Volk 2001).
3. Since data on ICD-9 diagnosis codes were largely missing in our encounter data, we used additional information such as CPT procedure codes, place and type of service

codes, and service department codes to identify services related to ADM. This methodology was not possible for other conditions, such as diabetes or heart disease. Thus, we were unable to control for these conditions.

4. The prevalence of drinking in our sample (72.4 percent) is approximately the same as the past year prevalence in the NHSDA for users aged 18 and older (71.4 percent in 2001).

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